WHAT IS CLAIMED IS:

1. A graphic contour extracting method comprising:

acquiring an image of a graphic form to be inspected;

defining an inspection region for the image of the graphic form to be inspected by an inspection graphic form including at least one of a circle, an ellipse, a rectangle, a first rectangular graphic form, a second rectangular graphic form and a closed curved graphic form, at least one end of said first rectangular graphic form being replaced with any one of a semi-circle, a semi-ellipse and a parabola, at least one of four corners of said second rectangular graphic form being replaced with a 1/4 circle or a 1/4 ellipse, said closed curved graphic form being expressed by the following expression:

$$\frac{(x-x_0)^4}{a^4}+\frac{(y-y_0)^4}{b^4}=1,$$

and said inspection graphic form having an edge searching direction previously defined for at least one component thereof; and

searching an edge of the graphic form to be inspected on the basis of said inspection graphic form to acquire contour information of the graphic form to be inspected.

2. A graphic contour extracting method according to claim 1, wherein said first rectangular graphic form includes at least one of:

a graphic form, at least one end of which is replaced with said semi-circle, said semi-ellipse or said parabola so as to form a convex portion; and

a graphic form, at least one end of which is replaced with said semi-circle, said semi-ellipse or said parabola so as to form a concave portion.

3. A graphic contour extracting method according to claim 1, wherein defining of said inspection region includes defining said inspection region by combining a plurality of inspection graphic forms.

4. A graphic contour extracting method comprising:

acquiring an image of a graphical form to be inspected;

defining a potential function V for the image of the graphical form;

calculating a first group of curves which are formed by connecting equal values with respect to values expressed by said potential function V;

calculating a second group of curves which are substantially perpendicular to said first group of curves; and

searching a contour of the graphical form along said second group of curves to acquire contour information of the graphical form.

5. A graphic contour extracting method according to claim 4, wherein defining of said potential function V includes expressing a plane of the image by a complex plane $z = x + iy$ to define said potential function V on the basis of a density value or RGB value of a pixel positioned at $z_i = x_i + iy_i$ as a potential function V(z) at an arbitrary position z on the image so as to be a regular function;

calculating said first group of curves includes calculating a function W(z) which is led from the Cauchy-Riemann's relation with respect to said potential function V(z); and

calculating said second group of curves includes calculating a group of curves on the z plane on which W is a constant.

6. A graphic contour extracting method comprising:

acquiring an image of a graphical form to be inspected, the image being constituted by pixels;

preparing a polygonal line having a shape approximating the shape of the graphical form;

determining an edge searching direction on the basis of said polygonal line; and

analyzing a density distribution of the pixels of the image in said edge searching direction to detect coordinates of an edge point of the graphical form.

7. A pattern inspecting method comprising:

acquiring an image of a pattern to be inspected;

defining an inspection region for the pattern by an inspection graphic form including at least one of a circle, an ellipse, a rectangle, a first rectangular graphic form, a second rectangular graphic form and a closed curved graphic form, at least one end of said first rectangular graphic form being replaced with any one of a semi-circle, a semi-ellipse and a parabola, at least one of four corners of said second rectangular graphic form being replaced with a 1/4 circle or a 1/4 ellipse, said closed curved graphic form being expressed by the following expression:

$$\frac{(x-x_0)^4}{a^4}+\frac{(y-y_0)^4}{b^4}=1,$$

and said inspection graphic form having an edge searching direction previously defined for at least one component thereof; and

searching an edge of the pattern on the basis of said inspection graphic form to acquire contour information of the pattern.

8. A pattern inspecting method according to claim 7, wherein said first rectangular graphic form includes at least one of:

a graphic form, at least one end of which is replaced with said semi-circle, said semi-ellipse or said parabola so as to form a convex portion; and

a graphic form, at least one end of which is replaced with said semi-circle, said semi-ellipse or said parabola so as to form a concave portion.

9. A pattern inspecting method according to claim 7, wherein defining of said inspection region includes defining said inspection region by combining a plurality of inspection graphic forms.

10. A pattern inspecting method comprising:

acquiring an image of a pattern to be inspected;

defining a potential function V for the image of the pattern;

calculating a first group of curves which are formed by connecting equal values with respect to values expressed by said potential function V;

calculating a second group of curves which are substantially perpendicular to said first group of curves; and

searching a contour of the pattern along said second group of curves to acquire contour information of the pattern.

11. A pattern inspecting method according to claim 10, wherein defining of said potential function V includes expressing a plane of the image by a complex plane $z = x + iy$ to define said potential function V on the basis of a density value or RGB value of a pixel positioned at $z_1 = x_1 + iy_1$ as a potential function $V(z)$ at an arbitrary position z on the image so as to be a regular function;

calculating said first group of curves includes calculating a function $W(z)$ which is led from the Cauchy-Riemann's relation with respect to said potential function $V(z)$; and

calculating said second group of curves includes calculating a group of curves on the z plane on which W is a constant.

12. A pattern inspecting method comprising:

acquiring an image of a pattern to be inspected, the image being constituted by pixels;

preparing a polygonal line having a shape approximating the shape of the pattern;

determining an edge searching direction on the basis of said polygonal line; and

analyzing a density distribution of the pixels of the image in said edge searching direction to detect coordinates of an edge point of the pattern.

13. A pattern inspecting method according to claim 12, wherein said polygonal line is prepared on the basis of design data of the pattern.

14. A pattern inspecting method according to claim 12, wherein preparing of said polygonal line includes preparing a first polygonal line which is formed by combining a first segment in a first direction and a second segment in a second direction which is substantially perpendicular to said first direction, superposing said first

polygonal line on the image and preparing a second polygonal line by cutting a region of said first polygonal line by a desired amount about a vertex of said first polygonal line,

said edge searching direction is determined on the basis of said second polygonal line.

15. A pattern inspecting method according to claim 14, wherein preparing of said second polygonal line includes cutting a corner of said first polygonal line along a direction perpendicular to a straight line which divides an angle into two equal parts, the angle being formed by the vertex and two line segments intersecting at the vertex, of segments constituting said first polygonal line.

16. A pattern inspecting method according to claim 14, wherein said edge searching direction is a direction perpendicular to said second polygonal line.

17. A pattern inspecting method according to claim 15, wherein determining of said edge searching direction includes drawing a circle the central point of which locates an arbitrary point on a straight line which is perpendicular to a segment line constituting a cut-out portion and which divides said segment line of said cut-out portion into two equal parts and selecting said edge searching direction in a cut-out portion of said second polygonal line from straight lines drawn between points on said circle and said central point.

18. A pattern inspecting method according to claim 14, wherein preparing of said first polygonal line includes preparing said first polygonal line on the basis of a schematic contour shape of the pattern obtained by processing the image.

19. A pattern inspecting method according to claim 12, wherein preparing said polygonal line includes carrying out a pattern matching between a first template and said schematic contour shape, said first template being constituted by a rectangle including at least one of a straight line and a hook line therein or by two rectangles which hold one vertex in common and are similar figures to each other.

20. A pattern inspecting method according to claim 14, wherein preparing said first polygonal line includes carrying out a pattern matching between a second template and the image or a processed image or between a third template and the image or said processed image , said second template being constructed by a first and a second rectangles which hold one vertex in common and are similar figures to each other, the region of said first rectangle and the remaining region being different from each other in two contrast attributes, said processed image being an image in which a difference in contrast in the image is clarified, said third template being constructed by a hook shape or third rectangle which holds one vertex in common, and the region of said hook shape and the remaining region being different from each other in said two contrast attributes.

21. A pattern inspecting method according to claim 19, wherein carrying out the pattern matching includes acquiring information about the number of vertices of the pattern from design data of the pattern and restricting the number of matching operations on the basis of information about the number of vertices.

22. A pattern inspecting method according to claim 19, wherein carrying out the pattern matching includes acquiring information whether the shape of the pattern is a closed curve from design data of the pattern and restricting the number of matching operations on the basis of said information.

23. A program for causing a computer to execute a graphic contour extracting method, said method comprising:

acquiring an image of a graphic form to be inspected;

defining an inspection region for the image of the graphic form to be inspected by an inspection graphic form including at least one of a circle, an ellipse, a rectangle, a first rectangular graphic form, a second rectangular graphic form and a closed curved graphic form, at least one end of said first rectangular graphic form being replaced with any one of a semi-circle, a semi-ellipse and a parabola, at least one of four corners of said second rectangular graphic form

being replaced with a 1/4 circle or a 1/4 ellipse, said closed curved graphic form being expressed by the following expression:

$$\frac{(x-x_0)^4}{a^4}+\frac{(y-y_0)^4}{b^4}=1,$$

and said inspection graphic form having an edge searching direction previously defined for at least one component thereof; and

searching an edge of the graphic form to be inspected on the basis of said inspection graphic form to acquire contour information of the graphic form to be inspected.

24. A program for causing a computer to execute a graphic contour extracting method, said method comprising:

acquiring an image of a graphical form to be inspected;

defining a potential function V for the image of the graphical form;

calculating a first group of curves which are formed by connecting equal values with respect to values expressed by said potential function V;

calculating a second group of curves which are substantially perpendicular to said first group of curves; and

searching a contour of the graphical form along said second group of curves to acquire contour information of the graphical form.

25. A program for causing a computer to execute a graphic contour extracting method, said method comprising:

acquiring an image of a graphical form to be inspected, the image being constituted by pixels;

preparing a polygonal line having a shape approximating the shape of the graphical form;

determining an edge searching direction on the basis of said polygonal line; and

analyzing a density distribution of the pixels of the image in said edge searching direction to detect coordinates of an edge point of the graphical form.

26. A program for causing a computer to execute a pattern inspecting method, said method comprising:

acquiring an image of a pattern to be inspected;

defining an inspection region for the pattern by an inspection graphic form including at least one of a circle, an ellipse, a rectangle, a first rectangular graphic form, a second rectangular graphic form and a closed curved graphic form, at least one end of said first rectangular graphic form being replaced with any one of a semi-circle, a semi-ellipse and a parabola, at least one of four corners of said second rectangular graphic form being replaced with a 1/4 circle or a 1/4 ellipse, said closed curved graphic form being expressed by the following expression:

$$\frac{(x-x_0)^4}{a^4}+\frac{(y-y_0)^4}{b^4}=1,$$

and said inspection graphic form having an edge searching direction previously defined for at least one component thereof; and

searching an edge of the pattern on the basis of said inspection graphic form to acquire contour information of the pattern.

27. A program for causing a computer to execute a pattern inspecting method, said method comprising:

acquiring an image of a pattern to be inspected;

defining a potential function V for the image of the pattern;

calculating a first group of curves which are formed by connecting equal values with respect to values expressed by said potential function V;

calculating a second group of curves which are substantially perpendicular to said first group of curves; and

searching a contour of the pattern along said second group of curves to acquire contour information of the pattern.

28. A program for causing a computer to execute a pattern inspecting method, said method comprising:

acquiring an image of a pattern to be inspected, the image being constituted by pixels;

preparing a polygonal line having a shape approximating the shape of the pattern;

determining an edge searching direction on the basis of said polygonal line; and

analyzing a density distribution of the pixels of the image in said edge searching direction to detect coordinates of an edge point of the pattern.

29. A pattern inspecting system comprising:

an image acquiring part which acquires an image of a pattern to be inspected;

an inspection region defining part which defines an inspection region for the pattern by preparing an inspection graphic form including at least one of a circle, an ellipse, a rectangle, a first rectangular graphic form, a second rectangular graphic form and a closed curved graphic form, at least one end of said first rectangular graphic form being replaced with any one of a semi-circle, a semi-ellipse and a parabola, at least one of four corners of said second rectangular graphic form being replaced with a 1/4 circle or a 1/4 ellipse, said closed curved graphic form being expressed by the following expression:

$$\frac{(x-x_0)^4}{a^4}+\frac{(y-y_0)^4}{b^4}=1\,,$$

and said inspection graphic form having an edge searching direction previously defined for at least one component thereof; and

a contour extracting part which searches an edge of the pattern on the basis of said inspection graphic form to acquire contour information of the pattern.

30. A pattern inspecting system according to claim 29, wherein said first rectangular graphic form includes at least one of:

a graphic form, at least one end of which is replaced with said semi-circle, said semi-ellipse or said parabola so as to form a convex portion; and

a graphic form, at least one end of which is replaced with

said semi-circle, said semi-ellipse or said parabola so as to form a concave portion.

31. A pattern inspecting system according to claim 29, wherein said inspection region defining part defines said inspection region by combining a plurality of inspection graphic forms.

32. A pattern inspecting system according to claim 29, which further comprises:

a display part including a display screen which displays the image and said inspection graphic form;

a GUI which alternatively displays a candidate graphic form for said inspection graphic form or its component on said display screen, said candidate graphic form including at least one of said circle, said ellipse, said rectangle, said first rectangle, said second rectangle and said closed curve, and said edge searching direction being previously defined for every shape to form; and

an input part which assigns a reference position and said proposed graphic form, said reference point providing a reference when said inspection region is defined on said display screen;

wherein said inspection region defining part defines said inspection region on the basis of said reference position assigned by said input part and said candidate graphic form.

33. A pattern inspecting system comprising:

an image acquiring part which acquires an image of a pattern to be inspected;

a calculating part which defines a potential function V for the image of the pattern, calculates a first group of curves which are formed by connecting equal values with respect to values expressed by said potential function V, and calculates a second group of curves which are substantially perpendicular to said first group of curves; and

a contour extracting part which searches a contour of the pattern along said second group of curves to acquire contour information of the pattern.

34. A pattern inspecting system according to claim 33, wherein said calculating part expresses a plane of the image by a complex plane $z = x + iy$ to define said potential function V on the basis of a density value or RGB value of a pixel positioned at $z_i = x_i + iy_i$ as a potential function V(z) at an arbitrary position z on the image so as to be a regular function,

said first group of curves is a function W(z) which is led from the Cauchy-Riemann's relation with respect to said potential function V(z), and

said second group of curves are a group of curves on the z plane on which W is a constant with respect to said function W(z).

35. A pattern inspecting system comprising:

an image acquiring part which acquires an image of a pattern to be inspected, the image being constituted by pixels;

a polygonal line preparing part which prepares a polygonal line having a shape approximating the shape of the pattern;

an edge searching direction determining part which determines an edge searching direction on the basis of said polygonal line; and

a contour extracting part which analyzes a density distribution of the pixels in said edge searching direction to detect coordinates of an edge point of the pattern.

36. A pattern inspecting system according to claim 35, wherein said polygonal line preparing part acquires design data of the pattern to prepare said polygonal line on the basis of said design data.

37. A pattern inspecting system according to claim 35, wherein said polygonal line preparing part includes:

a first polygonal line preparing part which prepares a first polygonal line which is formed by combining a first segment in a first direction and a second segment in a second direction which is substantially perpendicular to said first direction;

a cut-out processing part which superposes said first polygonal line on the image of the pattern and prepares a second polygonal line by cutting a region of said first polygonal line by

a desired amount about a vertex of said first polygonal line,

wherein said edge searching direction determining part determines said edge searching direction on the basis of said second polygonal line.

38. A pattern inspecting system according to claim 37, wherein said cut-out processing part cuts a corner of said first polygonal line along a direction perpendicular to a straight line which divides an angle into two equal parts, the angle being formed by the vertex and two line segments intersecting at the vertex, of segments constituting said first polygonal line.

39. A pattern inspecting system according to claim 37, wherein said edge searching direction determining part draws a circle the central point of which locates an arbitrary point on a straight line which is perpendicular to a segment line constituting a cut-out portion and which divides said segment line of said cut-out portion into two equal parts and selects said edge searching direction in a cut-out portion of said second polygonal line from straight lines drawn between points on said circle and said central point.

40. A pattern inspecting method according to claim 35, which further comprises a storage part which stores a first template which are constituted by a rectangle including at least one of a straight line and a hook line therein or by two rectangles which hold one vertex in common and are similar figures to each other,

wherein said polygonal line preparing part carries out a pattern matching between a schematic contour shape of the pattern and said first template, said schematic contour shape being obtained by processing the image of the pattern.

41. A pattern inspecting system according to claim 40, which further comprises a storage part which stores at least one of a second template and a third template, said second template being constructed by a first and a second rectangles which hold one vertex in common and are similar figures to each other, the region of said first rectangle and the remaining region being different from each other

in two contrast attributes, and said third template being constructed by a hook shape and a third rectangle which holds one vertex in common and the region of said hook shape and the remaining region being different from each other in said two contrast attributes,

wherein said polygonal line preparing part carries out a pattern matching between said second template and the image or a processed image or between said third template and the image or said processed image, said processed image being an image in which a difference in contrast in the image is clarified.

42. A pattern inspecting system according to claim 40, wherein prior to said pattern matching, said polygonal line preparing part acquires information about the number of vertices of the pattern from design data of the pattern and previously restricts the number of matching operations on the basis of information about the number of vertices.

43. A pattern inspecting system according to claim 40, wherein prior to said pattern matching, said polygonal line preparing part acquires information whether the pattern is a closed curve from design data of the pattern and previously restricts the number of matching operations on the basis of said information.